

REMARKS

This application has been reviewed in light of the Office Action dated December 23, 2009. Claims 1-8, 12 and 13 are presented for examination, of which Claims 1, 12 and 13 are in independent form. Claims 12 and 13 have been amended to define still more clearly what Applicants regard as their invention. Favorable reconsideration is respectfully requested.

Initially, Applicants agree with and adopt the Examiner Interview Summary dated September 22, 2009. To the extent relevant to the current rejections, points discussed are repeated below.

In the outstanding Office Action, Claims 12 and 13 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. Without conceding the validity of the above-mentioned rejection, Applicants have nonetheless amended these claims to eliminate this as an issue. It is believed that the above-mentioned rejection has been obviated and its withdrawal is, therefore, respectfully requested.

Claims 1-8 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent 6,180,870 (Sano et al.) in view of U.S. Patent 5,021,100 (Ishihara et al.) and further in view of Japanese Patent Application Publication 2000-150934 (Nakajima et al.), and Claims 12 and 13, as being unpatentable over Japanese Patent Application Publication 2003-188401 (Yamashita et al.) in view of U.S. Patent 6,787,069 (Kohiki et al.).

Applicants submit that the independent claims, together with their dependent claims, are patentable over the cited prior art for at least the following reasons.

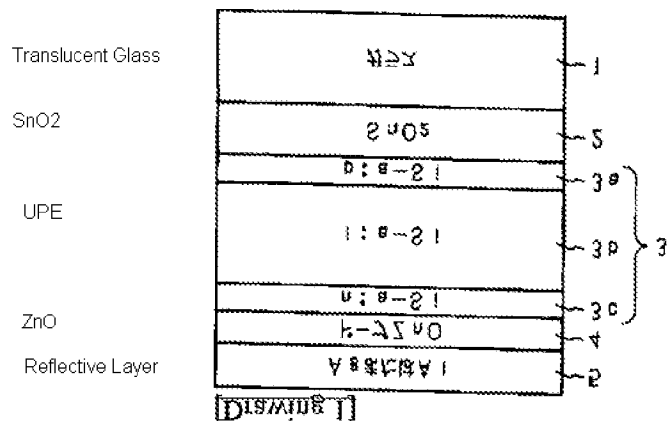
Claim 1

The nature of the present invention and that of the cited references have been adequately discussed in previous Amendments, and it is not believed necessary to repeat that discussion in full.

However, Applicants would like to make further clarifications as follows. In general, the ZnO or SnO₂ layers in a photovoltaic apparatus act as transparent conductors (*see* http://en.wikipedia.org/wiki/Transparent_conducting_film¹) in that such layers should allow light to pass through without preventing electricity to be transmitted into and collected out of such layers.

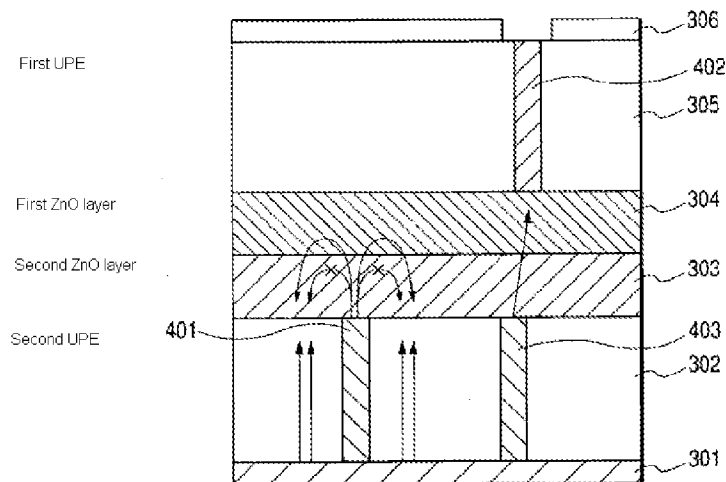
In *Nakajima*, the photovoltaic apparatus contains only one unit photovoltaic element (UPE) rather than multiple ones (*see* Drawing 1 attached below; while the legends in the Drawing itself appear upside-down, the Drawing is shown in the intended orientation, and the legends standing to the left of the Drawing itself are correct). With respect to the ZnO layer, the UPE is necessarily located at only one of its two sides. Therefore, it is important to make only that side a good electric junction. To achieve that purpose, the impurity of the side of the ZnO layer that is adjacent to the UPE is made higher to create a lower resistance, but not too high for the light reflected from the reflective layer to pass through and reach the UPE.

¹ It is to be noted that this site is not cited as evidence of any sort, but is merely referred to as providing a clear discussion of this point.



According to certain aspects of the present invention, on the other hand, the photovoltaic apparatus contains at least two UPEs (Fig. 4 attached below). With respect to the set of two ZnO layer, an UPE is located at each of its two sides. Therefore, Applicants submit that there is no reason to make one of the two sides a better electric junction than the other.

FIG. 4



Accordingly, even assuming that the combination of *Sano* and *Ishihara* were permissible and would offer a photovoltaic apparatus according to the certain aspects of the present invention, there does not appear to be any motivation for applying the teaching of *Nakajima* to this combination.

The Office Action states that maintaining transparency is desirable. Applicants submit, however, that this feature is already disclosed in the present application, or there would be no light reaching the second UPE. Therefore, even if the above-mentioned combination were permissible and would offer a photovoltaic apparatus according to the certain aspects of the present invention, this feature does not provide any motivation for applying the teaching of *Nakajima* to the combination.

The Office Action further states that when there is motivation to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the good options. Applicants submit, however, even if the above-mentioned combination were permissible and would offer a photovoltaic apparatus according to the certain aspects of the present invention, no problem exists – without the hindsight obtained from reviewing the present application – in this combination that would require the variation of resistance within the set of ZnO layers in any way. In the absence of a problem, no solution will be sought for.

Accordingly, for at least the reasons noted above, Claim 1 is believed patentable over *Sano*, *Ishihara*, and *Nakajima*, considered separately or in any permissible combination.

Claims 12 and 13

Applicants would like to make further clarifications regarding the aspects of the present invention to which these claims are directed. According to these aspects of the present invention, a photovoltaic apparatus is formed by layer by layer at least to some extent (Fig. 7). Specifically, an I₂O₃ layer is deposited onto a photovoltaic element, and a ZnO layer is deposited onto the I₂O₃ layer (para. [0072], para. [0152] and para. [0154]). It is advantageous to have the

ZnO layer deposited at a higher rate than the I_2O_3 layer partly for economic reasons (para. [0067]), and to have the ZnO layer deposited at a higher temperature than the I_2O_3 layer partly due to the diffusing nature of Indium (para. [0068]).

Claim 12 recites, among other features, “depositing a first layer mainly composed of indium oxide on at least one interface with the unit photovoltaic element; and depositing a second layer mainly composed of zinc oxide on and in direct contact with the first layer, wherein... the second layer is deposited at a rate higher than the first layer.” Similarly, Claim 13 recites, among other features, that “the second layer is deposited at a temperature lower than the first layer.”

These features are not believed to be disclosed or suggested in *Yamashita* and *Kohiki*, considered separately or in any permissible combination.² While conceding that these features or similar ones are not disclosed in *Yamashita*, the Office Action suggests that they are in *Kohiki*. Applicants respectfully disagree.

As Applicants understand, *Kohiki* relates to a compound prepared by introducing an element belonging to an alkali metal group or a transitional metal group into a vacant lattice point of I_2O_3 crystal having Sc_2O_3 type translational symmetric crystalline structure (*see* Abstract). While *Kohiki* might involve the formation of an $I_2O_3 Li_x$ compound, focusing on the addition of Li^+ into I_2O_3 (*see* col. 5, lines 7-11), it clearly does not discuss the deposition of an I_2O_3 layer, and certainly not onto an UPE. Similarly, *Kohiki* does not discuss at all the deposition of a ZnO layer, and certainly not onto an I_2O_3 layer.

Accordingly, for at least the reasons noted above, Claims 12 and 13 are believed patentable over *Yamashita* and *Kohiki*, considered separately in any permissible combination.

A review of the other art of record has failed to reveal anything which, in Applicants' opinion, would remedy the deficiencies of the art discussed above, as references against the independent claims herein. Those claims are therefore believed patentable over the art of record.

The other claims in this application are each dependent from one or another of the independent claims discussed above and are therefore believed patentable for the same reasons. Since each dependent claim is also deemed to define an additional aspect of the invention, however, the individual reconsideration of the patentability of each on its own merits is respectfully requested.

In view of the foregoing remarks, Applicants respectfully request favorable reconsideration and early passage to issue of the present application.

Applicants' undersigned attorney may be reached in our New York office by telephone at (212) 218-2100. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,

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2 These features are also not believed to be disclosed or suggested in *Ishihara* and U.S. Patent 6,468,885 (Mahan et al.), considered separately or in any permissible combination.